Tonic and Phasic Dopamine Fluctuations as Reflected in Beta-power Predict Interval Timing Behavior

Kononowicz, Tadeusz; van Rijn, Hedderik

Published in:
Procedia: Social and Behavioral Sciences

DOI:
10.1016/j.sbspro.2014.02.313

Available online at www.sciencedirect.com

ScienceDirect

Procedia - Social and Behavioral Sciences 126 (2014) 47

Procedia
Social and Behavioral Sciences

ICTTP 2014

Tonic and phasic dopamine fluctuations as reflected in beta-power predict interval timing behavior

Tadeusz Kononowicz[1,2,3], Hedderik van Rijn[3]

[1]*NeuroSpin Center, CEA, DSV/I2BM, Gif/Yvette, France*
[2]*Cognitive Neuroimaging Unit, Brain Dynamics, INSERM, U992, Gif/Yvette, France*
[3]*Department of Psychology, University of Groningen, Groningen, The Netherlands*

Abstract

It has been repeatedly shown that dopamine impacts interval timing in humans and animals (for a review, see Coull, Cheng, & Meck, 2012). Particularly, administration of dopamine agonists or antagonists speeds-up or slows down internal passage of time, respectively (Meck, 1996). This co-variations in the dopamine level and clock speed has been typically induced by pharmacological manipulations (e.g., Lustig & Meck, 2005). However, it has not been assessed whether naturally occurring fluctuations in dopamine level are sufficient for altering interval timing performance. Recent advances in neurophysiology suggest that tonic and phasic changes of dopamine level in cortical-basal ganglia loop can be traced by fluctuations of beta power (Jenkinson & Brown, 2011). We assessed dopamine levels by measuring the beta power while participants were asked to produce time intervals by two key presses. Both tonic levels of dopamine as measured by the beta power before interval initiation and phasic level of dopamine as measured after the first key-press predict timing performance. These positive correlations between beta power and length of produced intervals support the notion that dopamine plays an important role in interval timing, even in the range of naturally occurring fluctuations.

Keywords: Dopamine; Interval Timing; Beta-Power; EEG

References

Coull, J. T., Cheng, R. K., & Meck, W. H. (2011). Neuroanatomical and neurochemical substrates of timing. *Neuropsychopharmacology*, *36*(1), 3-25.

Jenkinson, N., & Brown, P. (2011). New insights into the relationship between dopamine, beta oscillations and motor function. *Trends in Neurosciences*, *34*(12), 611-618.

Lustig, C., & Meck, W. H. (2005). Chronic treatment with haloperidol induces deficits in working memory and feedback effects of interval timing. *Brain and Cognition*, *58*(1), 9-16.

Meck, W. H. (1996). Neuropharmacology of timing and time perception. *Cognitive Brain Research*, *3*(3-4), 227-242.

doi:10.1016/j.sbspro.2014.02.313